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Specification and Drawings, as originally filed, with Application for Patent Serial No:
2,412,073, on November 19, 2002, by TED MARCHILDON(CO-APPLICANT,
INVENTOR) and BETTY STOREY, for "Plant Growing Apparatus".

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Abstract of the Disclosure

5 An apparatus for growing plants in a plurality of rotatable, cylindrical drums, in which plants grow radially inwardly of the drum, has support means, such as rails, worm gears or a Ferris wheel-type structure, to support the drums for movement from one part of the apparatus to the other. The apparatus has means to rotate the drums about their axis as they are moved through the apparatus, and means to provide water to the plants as the drums move and rotate.

PLANT GROWING APPARATUS

Technical Field

[0001] The invention pertains to hydroponic and aeroponic gardening apparatuses, and in particular to apparatuses using rotating growing
5 drums.

Background

[0002] It is known to grow plants in a rotary growing apparatus comprising an open-ended drum which rotates about a generally horizontal axis with a lamp positioned inside the drum. As the drum rotates, water and nutrients are provided to the plants. Such a plant growing apparatus is disclosed in Canadian Patent No. 2,343,254 (Marchildon). In such apparatus, the growing plants are held in containers attached to the circumference of the cylindrical drum and grow
10 radially inward toward the light, with their roots growing radially outward of the drum. It would be desirable to provide an apparatus for supporting a plurality of rotary plant growing drums within a relatively confined space, while permitting the grown plants to be conveniently
15 harvested.

Summary of Invention

[0003] The invention provides an apparatus and method for growing plants in a plurality of cylindrical drums. The drums are rotated as they move from one position to another of the apparatus, with water and
20 nutrients being supplied to the plants as the drums are moved. The drums are moved to a position in which the plants can be easily harvested. The apparatus has support means, such as one or more rails, adapted to support a plurality of cylindrical growing drums and to permit their movement from one position to another, means for rotating
25 each drum about its axis, and means for providing water and nutrients to plants growing in the drums as the drums move. The apparatus facilitates the use of multiple growing drums in a relatively confined space.
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- 2 -

Brief Description of Drawings

[0004] Figure 1 is a perspective view of a first embodiment of the invention.

5 **[0005]** Figure 2 is a further perspective view of the apparatus of Figure 1, showing movement of a single drum through a water tray.

[0006] Figure 3 is a closeup perspective view of a drum drive mechanism positioned in the channel of a rail in the apparatus of Figure
10 1.

[0007] Figure 4 is a closeup perspective view of the drum driving mechanism of Figure 3 with the rail of the apparatus removed.

15 **[0008]** Figure 5 is a perspective view of a second embodiment of the invention.

[0009] Figure 6 is a further perspective view of the apparatus of Figure 5.
20

[0010] Figure 7 is a perspective view of a third embodiment of the invention.

[0011] Figure 8 is a side elevation view of the apparatus of Figure
25 7.

[0012] Figure 9 is a perspective view of a fourth embodiment of the invention.

30 **[0013]** Figure 10 is a front elevation view of the apparatus of Figure 9.

- 3 -

[0014] Figure 11 is a side perspective view of a drum, support apparatus and water tray of the apparatus of Figure 9.

5 **[0015]** Figure 12 is a perspective view of a fifth embodiment of the invention.

[0016] Figure 13 is a side elevation view of the apparatus of Figure 12.

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Description of the Preferred Embodiments

[0017] Throughout the following description, specific details are set forth in order to provide a more thorough understanding of the invention. However, the invention may be practiced without these
15 particulars. In other instances, well known elements have not been shown or described in detail to avoid unnecessarily obscuring the invention. Accordingly, the specification and drawings are to be regarded in an illustrative, rather than a restrictive, sense.

20 **[0018]** In each of the preferred embodiments of the invention, rotatable cylindrical drums are employed for hydroponically or aeroponically growing plants. The drums may be of the type disclosed in Canadian Patent 2,343,254 (Marchildon) or other designs that would function in the apparatus of the present invention. Each drum 14 is an
25 open-ended cylinder adapted to hold containers, such as pots, trays, etc., which contain the plants and a growing medium for their roots, and which hold the plants so as to grow radially inwardly of the drum. The containers have openings therein so water can be supplied to the plants, for example, when the plants are put in a watering tray or by the appli-
30 cation of a spray. Each drum has a light source 16, such as a battery-powered lamp, supported inside the drum, preferably at or near its

- 4 -

longitudinal axis, by a support member 18 affixed to the inside of the drum. Drum 14 may be any convenient size, for example four feet in diameter and six feet in length. For convenience of illustration, and since this application is directed to the apparatus for supporting and moving the drums, rather than the drums themselves, details of the structure of the drums are not shown in the drawings.

[0019] Figures 1 - 4 illustrate a first embodiment of the invention. Apparatus 10 has four rails 12 having U-shaped channels, the rails being adapted to support and permit rotational movement of the cylindrical drums 14. Rims 20 at each end of drum 14 are adapted to be held in channels 22 of the rails 12. Drums 14 are moved by rotation along rails 12, i.e. from left to right in the view of Figure 1. It will be understood that rims 20 fit loosely within upper rails 12, so the rotation and movement of the drums is not hindered. A water tray 24 is provided beneath the lowers rails 12, and the rails dip into the water tray at a point so that the containers on the circumference of drums 14 move into and through the trays 24, permitting watering of the plants in the drums. The drums can be moved along rails 20 by any convenient means. For example, as shown in Figures 2 - 4, individual drive units 26 may be provided for each drum. Drive unit 26 comprises motorized drive wheel 32 adapted to engage the outer edge of rim 20, which is held between drive wheel 32 and rim wheel 34. Channel wheels 28, 30 are adapted to fit in channel 22 of the rails. As drive wheel 32 rotates counterclockwise, in the view of Figure 3, drum 14 is rotated clockwise and thereby moved from left to right across rails 12. Drums 14 may also be moved by a suitable chain drive, belt drive or other means.

[0020] Drums 14 may also be moved by gravity. In this case, rails 12 are inclined so that drums 14 roll down them under the force of gravity. It is contemplated that the drums would preferably be rotated

- 5 -

relatively slowly, for example one rotation per hour and would abut against one another at their rims. Removal of the lowermost drum from the apparatus 10 would permit the remaining drums to rotate down by the distance of one drum diameter.

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[0021] Apparatus 10 may be substantially larger and hold more drums than has been shown in Figure 1. For example, rails 12 may be configured to extend from left to right at an incline and then turned downward and extend from right to left at an incline, with each drum
10 being held by means of rails 12 and supported by the drums below it in the apparatus during such downward turn. Multiple such turns may be provided, permitting a large number of drums to be supported and moved back and forth across a vertical plane, and come to a bottommost position of the apparatus. Multiple water trays 24, suitably spaced
15 along the apparatus, may be provided, or water may be fed to the plants by means of sprayheads positioned at suitable locations. At the bottom position, each drum can be removed from the apparatus and lifted to the topmost end of the apparatus 10 and placed on rails 12 to again traverse the apparatus. If fully grown, the plants are harvested when the drum is
20 removed and it is replanted with seeds or seedlings before being placed in the upper end of the apparatus.

[0022] Figures 5 and 6 show a second embodiment of the invention. Apparatus 40 has a pair of rails 42. Drums 14 have axial rod 44
25 fixed and supported at the axis of the drum by means of supports 46. The ends of rod 14 are fitted within U-shaped channels 48 of rails 42 and rotate therein as the drum 14 rotates.

[0023] The drums may be moved along rail 42 by any convenient
30 means, for example chain or belt drive or by individual drive units. However, it is preferred that the drums be moved by means of gravity.

- 6 -

In such case, rails 42 may be configured so as to be inclined so that the drums 14 roll down them under the force of gravity. As with the embodiment of Figure 1, the apparatus may be substantially larger and hold more drums than illustrated. For example, rails 42 may be configured to extend from left to right at an incline and then turn downward and extend from right to left at an incline. Each drum would be removed from the apparatus 40 at a lower end position, then harvested and replanted as appropriate, and placed on rails 42 of the apparatus at an upper end.

[0024] Where the apparatus 40 is used with a plurality of drums 14 abutting one another, the drums are provided with rims (not shown) on their outer circumference having a low-friction outer surface (such as teflon) so that they can abut each other and rotate against each other without hampering their rotation and movement across the apparatus.

[0025] The plants are watered by means of water tray 24 or other means as described above in respect of the embodiment of Figure 1.

[0026] Figures 7 and 8 show a third embodiment of the invention. Apparatus 50 has a single rail 52, having oppositely-facing U-channels 54. Drum 12 is supported in the channels by means of a support apparatus 56 having a rotatable wheel 60 in each channel 54. The support apparatus 56 includes a pair of rotatable wheels 62 to support drum 12, one adjacent each longitudinal end thereof. Drive motor 64 is coupled to a wheel 62 to rotate it and thereby rotate drum 12.

[0027] The drums may be moved along rail 52 by any suitable means, including chain and belt drives, and individual drive mechanisms coupled to rail 52 and to supports 56. The drums may also be moved by gravity and in such case the rail 52 is inclined.

- 7 -

[0028] The drums 12 are removed when they come to an end of rail 52. Where rail 52 is inclined, the drums are removed when they came to the lower end of the rail 52. The plants are then harvested and drums replanted, as required, and the drums are lifted to the upper end of the apparatus and placed on rail 52 to again traverse the apparatus 50. Multiple drums, abutting or close to one another, may be provided on the apparatus 50. The plants growing in the drums are watered by means of water tray 24 or sprayers.

[0029] A fourth embodiment of the invention is shown in Figures 9 to 11. Apparatus 70 is a Ferris wheel-type configuration for moving rotatable drums 12 in a circular or oval path. Vertical supports 72 hold drive chain 74 which is driven by a motor 75 and supported on guide wheels 76. Drums 12 are held on hangers 78 which are held by drive chain 74. Each drum 12 has support wheels 62 and motor 64 (the same as shown in Figure 7) for causing rotation of the drum. As drive chain 74 is driven, the drums are moved through a revolution which passes them through water tray 24, watering the plants in the drums. As the apparatus makes a revolution, the individual drums are also being rotated. In order to water all of the plants in a drum, the drum would make one complete rotation while it is within water tray 24. Alternatively, watering can be done by means of suitably positioned sprayers.

[0030] At one point in the revolution of the apparatus 70, a drum may be removed for harvesting and replanting. The hanger 78 is adapted to permit such removal, for example by permitting outwardly telescoping movement of the support members to release the drum.

[0031] A fifth embodiment of the invention is shown in Figures 12 and 13. Apparatus 80 comprises frame 82 which rotatably supports two

- 8 -

worm gears 84. Drive means (not shown), such as an electric motor, is provided to rotate the worm gears. Drum 12 is supported on the worm gears, resting thereon on its axial rims 20. The teeth of the worm gears are configured to receive rims 20 such that, as the worm gears are rotated, the drum is both rotated and is moved along the worm gears from one end 86 of the frame 82 to the other end 88.

[0032] It is contemplated that the worm gears would support a plurality of drums 12 placed end to end, moving in tandem. The worm gears may be of any suitable length to support and convey a selected number of drums, and would be supported at intervals from beneath by means of rotating support wheels (not shown) that do not interfere with the lateral or rotational movement of the drums 12.

[0033] When a drum travels to the second end 88 of the frame, it is removed, the plants harvested and the drum replanted. The drum is then put back on the apparatus at the first end 86.

[0034] Although apparatus 80 is preferably positioned horizontally, it can be positioned so as to convey the drums along an upwardly or downwardly sloping incline. Two or more apparatuses may be stacked one above the other, leaving sufficient space for the mounting or removal of drums from the worm gears, so that many drums can be processed within a relatively compact volume of space.

[0035] Water is applied to the plants as the drums move along the frame 82 by means of sprayers (not shown) positioned at intervals along the frame, or by other convenient means.

[0036] As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possi-

- 9 -

ble in the practice of this invention without departing from the spirit or scope thereof. For example, the drums can be rotated at a wide range of speeds, for example relatively quickly, such as five revolutions per minute, or relatively slowly, such as one revolution per hour or slower.

- 5 Also, water can be fed to the plant roots by various means in addition to those described above. For example, it can be supplied by means of direct injection into the growing medium in the containers. In such case, a dispenser such as a hypodermic needle connected to a water conduit is arranged so as to be inserted through an opening in a con-
- 10 tainer held on the drum and to inject water into the container at selected positions of the drum on the plant growing apparatus. The movement of the needle (or a bank of such needles, positioned to inject water into a plurality of containers at the same time) can be controlled by a cam or other suitable means. Watering can also be done by fogging or other-
- 15 wise providing a saturated atmosphere for the plant roots. Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.

- 10 -

WHAT IS CLAIMED IS:

1. An apparatus for growing plants as described and illustrated herein.

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2. A method for growing plants as described and illustrated herein.

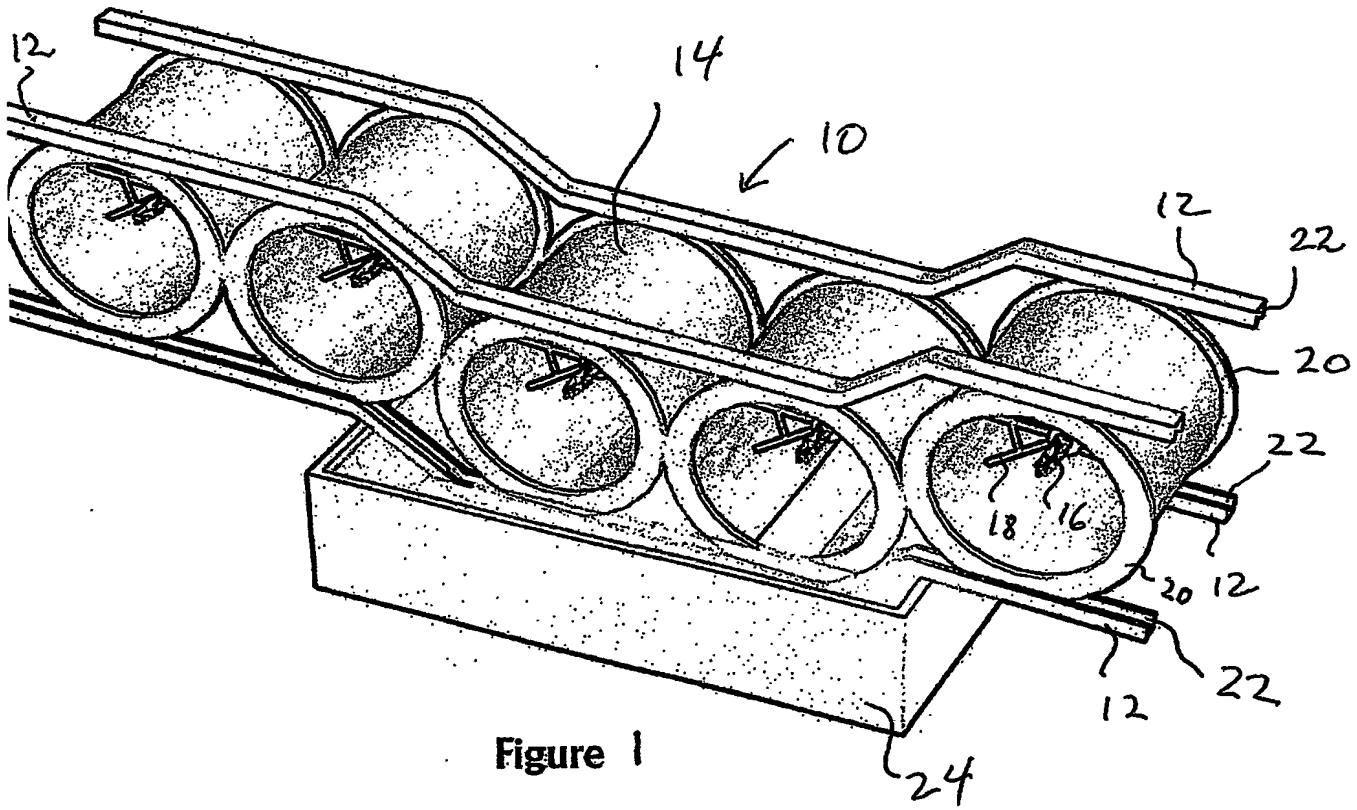


Figure 1

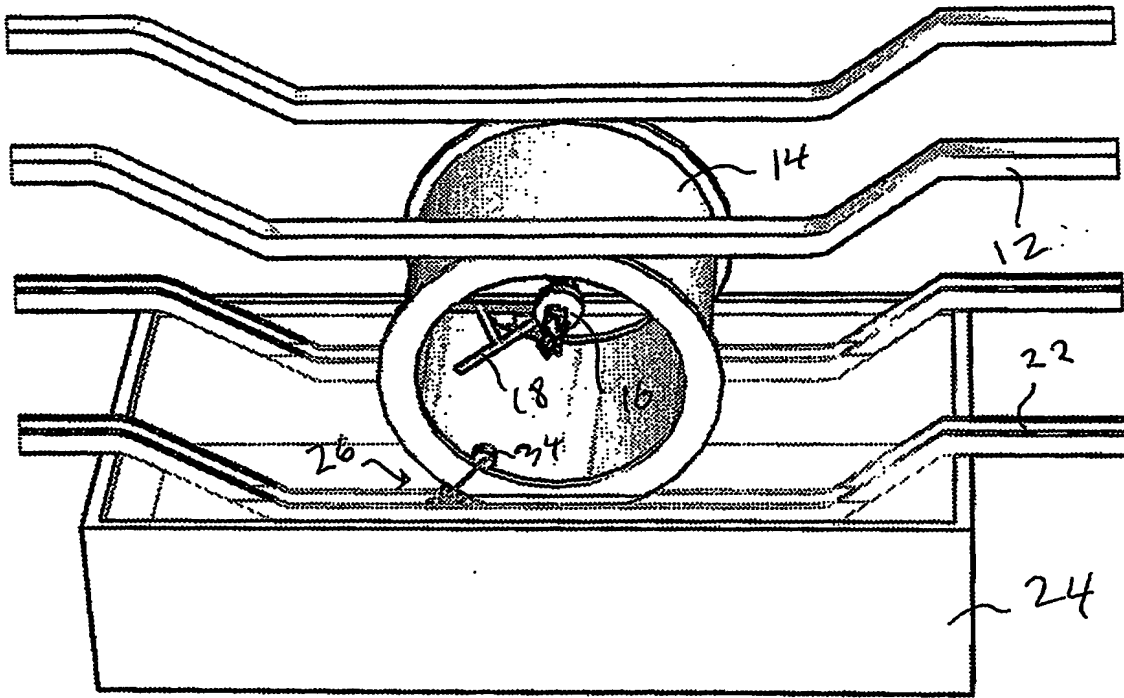


Figure 2

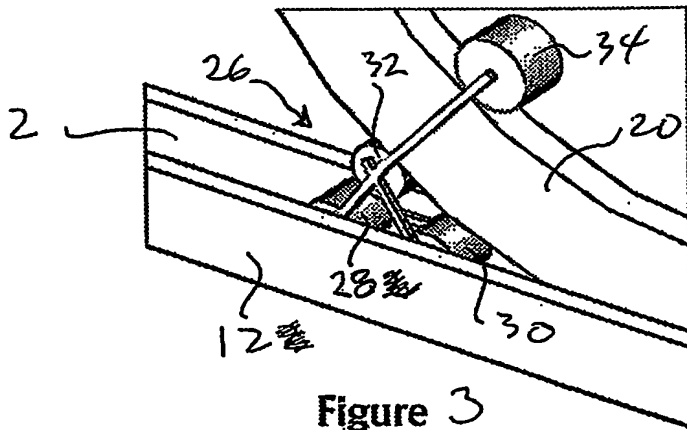


Figure 3

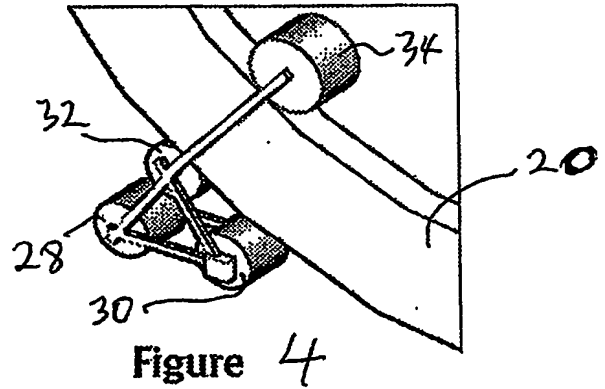


Figure 4

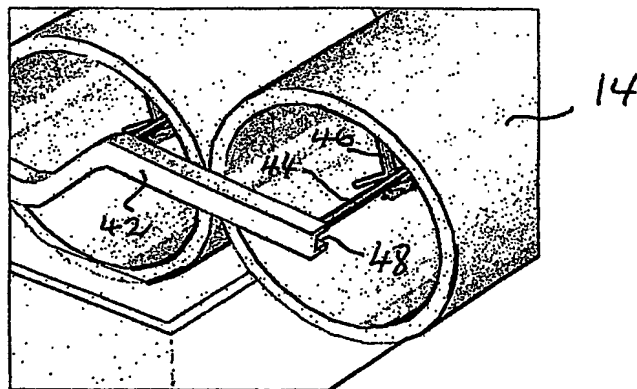
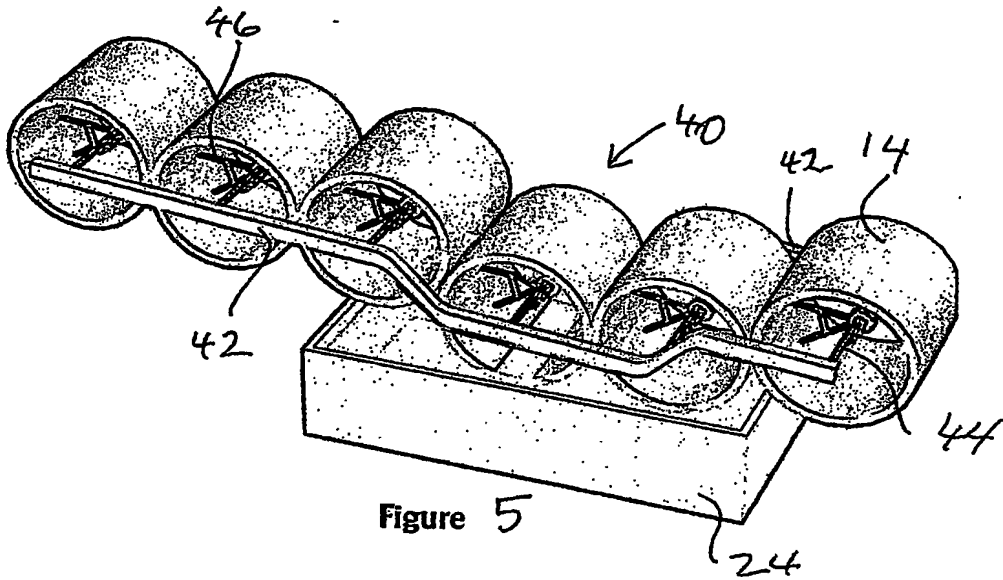


Figure 6

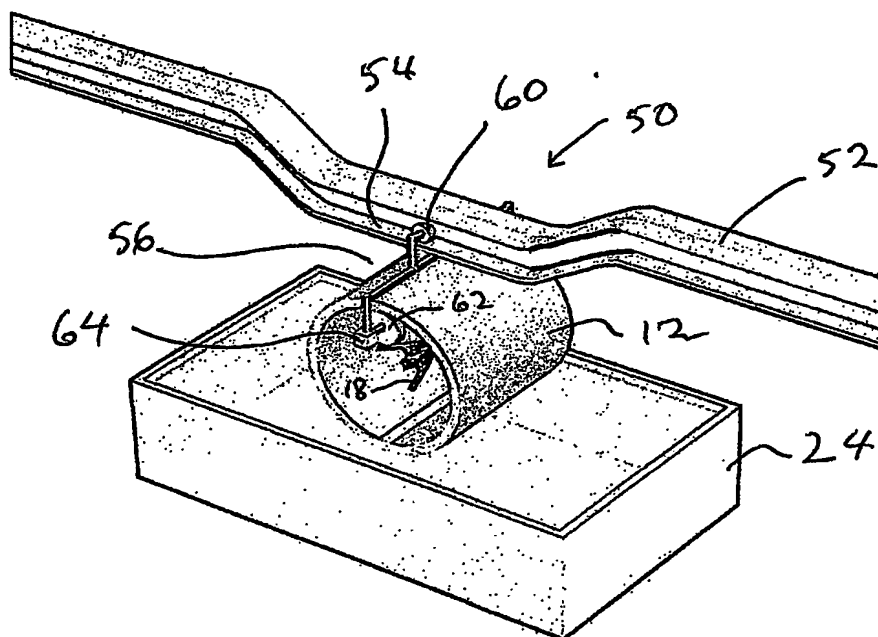


Figure 7

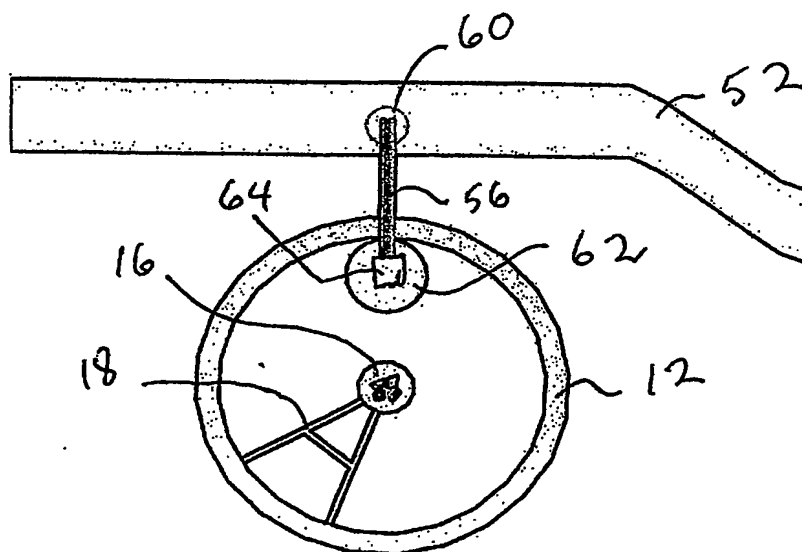


Figure 8

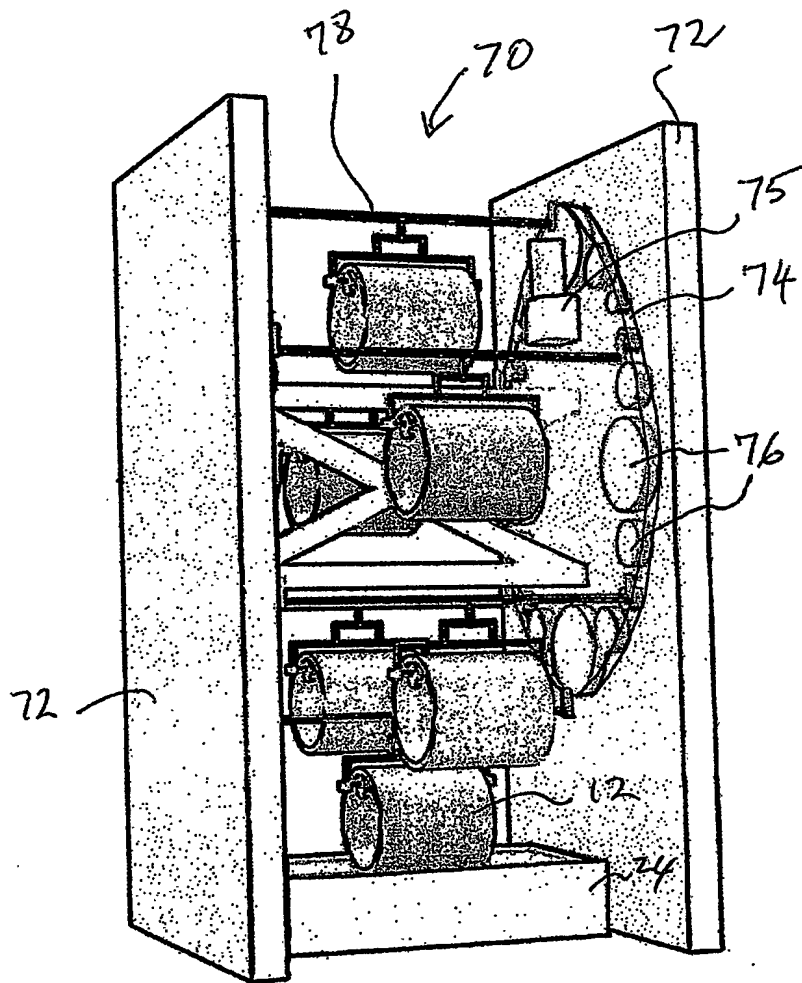


Figure 9

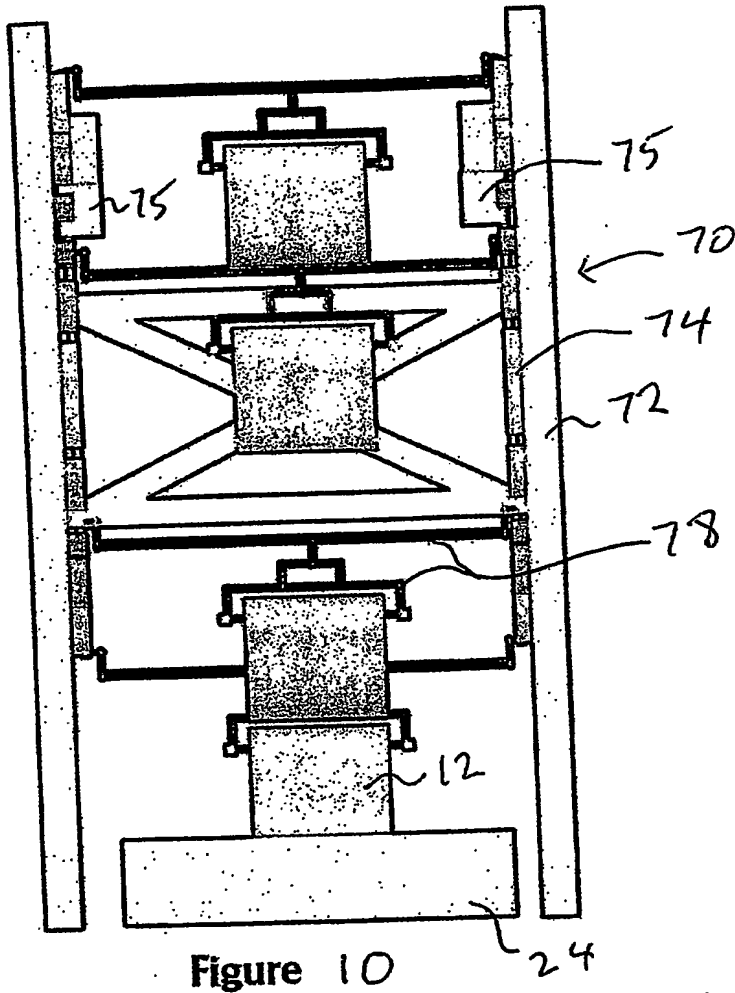


Figure 10

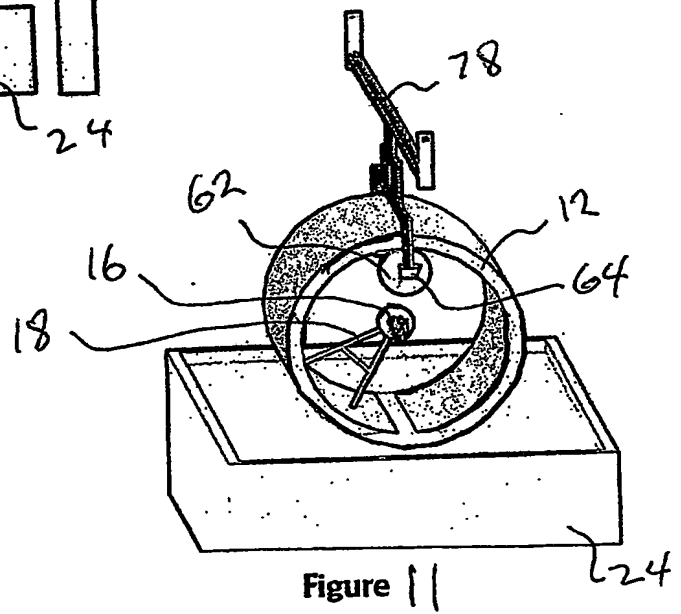


Figure 11

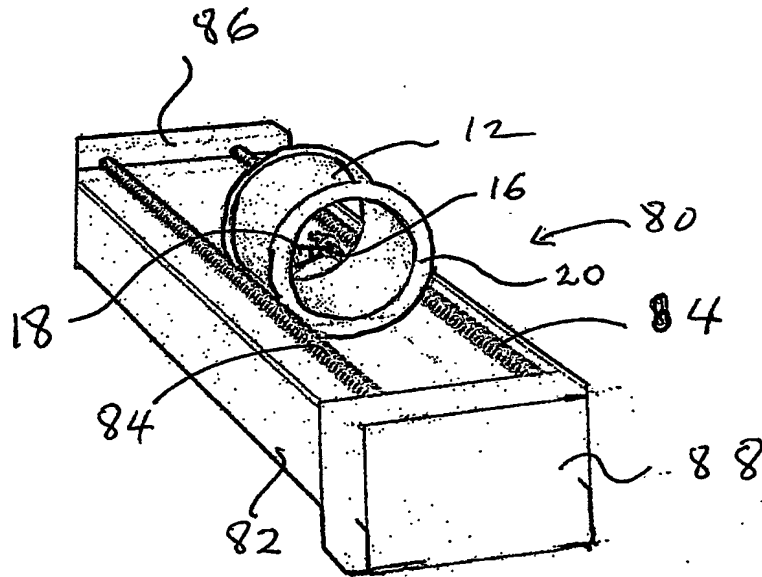


Figure 12

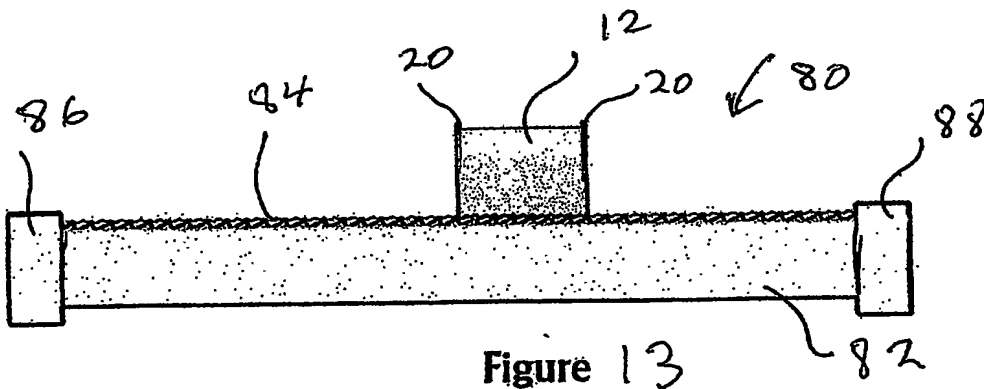


Figure 13

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